RESTORATION & ENHANCEMENT OPPORTUNITIES

FOR

THE CORSICA RIVER WATERSHED

Maryland Department of Natural Resources

Report Objective

The purpose of this document is to define opportunities for the restoration and enhancement of oysters, submerged aquatic vegetation and wetland, stream and associated habitats in the Corsica River Watershed. As part of this charge, this document will also identify opportunities for the treatment of stormwater discharges from the Town of Centreville to the Corsica River and associated tributaries.

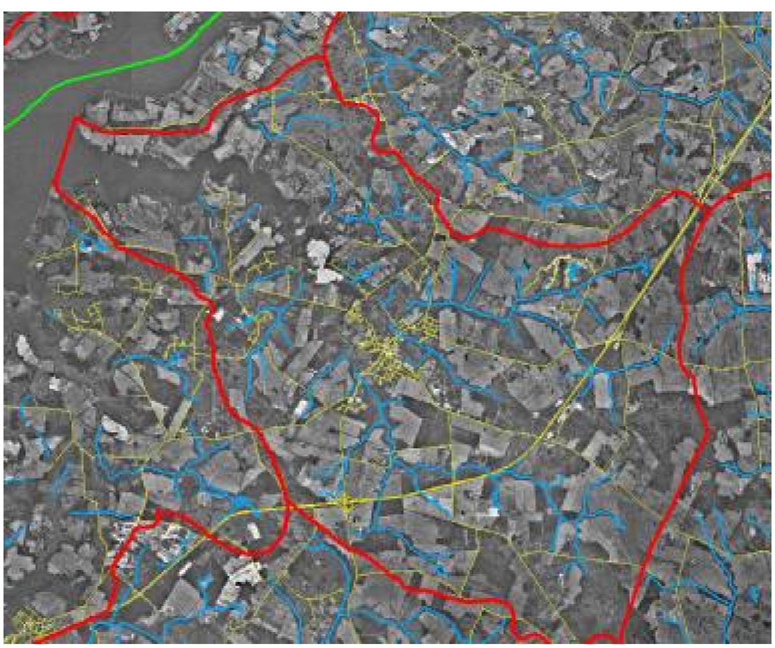
Wetland And Stream restoration opportunities

It has long been established that wetlands and streams play a vital role in providing critical ecological services to water quality and habitat. The loss and degradation of these resources in the Chesapeake Bay are a primary reason for impaired water quality and aquatic habitat. The lack of stormwater management and adequate treatment is also a major factor in impaired water quality of receiving waters.

In order to improve ecologic viability, particularly in the tidal portion of the Corsica River, it is necessary to assess and address the land management and practices in the upper portions of the watershed. This document will assess potential restoration and enhancement opportunities in the entire watershed which includes tidal and nontidal areas.

Watershed Characterization

The Corsica River watershed encompasses approximately 24,000 acres in central Queen Anne's County. The watershed includes one urban center, the Town of Centreville, which encompasses approximately 1.6 sq. miles of historic homes and businesses. The primary land use in the watershed is agriculture which encompasses approximately 64% of the watershed area. The secondary land use is forestry which encompasses approximately 28% of the land use. The remaining area is characterized as developed (7%) which includes residential and commercial areas.



Corsica River Watershed

The Corsica River watershed is divided into three smaller watersheds which include:

- Corsica Direct Drainage (8,382 acres)

- Mill Stream Branch (9,384 acres)
- Three Bridges Branch/Gravel Run (25,299 acres)

Water Quality

While not considered to be a highly developed watershed, water quality conditions in the watershed are considered to be degraded and/or impaired. This is primarily attributed to untreated runoff from farms, residential and developed areas. In addition, recent problems with the existing wastewater treatment plant in Centreville, has contributed to high levels of nutrient discharges into Gravel Run.

Wetlands

Wetland and stream habitat conditions within the watershed are also considered to be diminished. Tidal, or estuarine wetlands account for slightly less than 1% of the Corsica's watershed area. Nontidal, or palustrine wetlands account for approximately 10% of the watershed area. Wetland loss over the last few hundred years has been significant. Since European colonization, it is estimated that more than 4,000 acres of nontidal wetlands have been lost within the Corsica watershed. Many acres of tidal wetlands have been filled and armored for shore erosion control. The cumulative effect of these impacts has affected both water quality and habitat.

Streams

Channel alterations to streams appear to be relatively slight (only 2.4% of the streams surveyed as part of the Stream Corridor Assessment Survey completed in 2003). However, ditches and manmade extensions to headwater streams is a general practice in the watershed. These extensions serve to more rapidly convey flows (both base-flow and storm flow) out of the upper headwater areas and into the main channels. This practice can cause accelerated erosion and deposition within the stream channel and contribute to water quality problems downstream.

Unstable, eroding streams were identified at 57 sites within the Corsica watershed. These sites comprise a total of 12.18 miles (or 26%) of streams surveyed. 27 of these sites were ranked as moderate to severe. Excessive erosion from stream banks can play a major role in degrading downstream habitat and water quality,

Fish blockages, migration barriers were identified at 52 sites within the watershed. Some of these barriers are due to natural falls (logs, debris, etc.) and beaver dams, however 23 of these blockages were due to pipe crossings channelized streams, road crossings and dams. Blockages can disrupt of passage of spawning anadromous fish and can limit useable habitat for resident fish.

Watershed Conclusions

In order for there to be healthy oyster, fish and SAV populations in the tidal portions of the river, it is imperative that the notidal and the headwater areas have a degree of ecologic integrity. In order to improve the ecological services and value within the entire watershed, a plan of action for improving and restoring areas that have been degraded over the years must be enacted. This report will focus on the prioritization of those areas and specific actions that should be pursued.

Opportunities for Restoration and Enhancement

Tidal Wetlands

Opportunities for tidal wetlands restoration and enhancement are limited. Much of the filled tidal wetlands areas contain roads, buildings and other infrastructure that make it difficult to restore. Shoreline areas however, provide some opportunity for wetlands restoration and enhancement. This can be accomplished by the installation of fringe marshes along certain shoreline areas. Tidal wetlands dominated by common reed (Phragmites australis) are also potential tidal enhancement areas where phragmites dominated marshes can be controlled and more desirable species can be encouraged.

1. **Enhance Phragmites Dominated marshes –** controlling phragmites and encouraging more desirable species can enhance tidal marshlands.
2. **Tidal Fringe Wetlands and Living Shorelines** - Installation of tidal fringe marshes (living shorelines) and other habitat enhancements along tidal shorelines can help protect against erosion, provide habitat and improve water quality.
3. **Retrofit Armored Shorelines** - Retrofit of armored shorelines with living shoreline techniques can provide habitat and water quality benefits.

Nontidal Wetands

Nontidal wetland losses in the watershed are primarily due to agricultural practices. This is primarily due to the drainage of hydric soil areas for crop production. Obviously restoring the hydric soil areas that have been drained would be a first step in restoring nontidal wetlands in the watershed.

Many of the drained hydric soil are adjacent to forested areas (including floodplain and stream areas). Restoring hydric soils that abut existing forested areas, streams and floodplains provide the greatest ecological benefit. In addition, there are other opportunities for nontidal wetland restoration and enhancement listed below.

1. **Restore Drained Hydric Soils –** Focus on restoring the hydrological regime to drained and farmed hydric soils. Much of this work would be concentrated along floodplains and headwater seep areas. Specifically, the following soil series would be the focal point for restoration:

Bayboro (Bo)	Johnston (Jo)
Bibb (Bp)	Mixed Alluvial (My)
Bladen (Bt)	Othello (Ob)
Elkton (Ek)	Plummer (Pd)
Fallsington (Fa)	Pocomoke (Pk)

2. **Restore Degraded Delmarva Bays –** Many remnant Delmarva Bay features exist in the upland farmed areas of the Corsica Drainage. These remnant bays perform important functions for habitat and water quality. Many of these remnant bays are identifiable through soil and aerial maps.

3. **Enhancement of Ephemeral and Intermittent Stream channels –** Many streams or waterways extend from the 1st order streams, up into adjacent agricultural fields. These are typically intermittent or ephemeral channels. These areas can be sculpted to retain runoff from adjacent fields and can provide a valuable service in terms of water quality improvement.

4. **Expansion of Floodplains –** Floodplains can be expanded or, if applicable, enlarged to provide a more frequent communication with associated streams. This may require the excavation of floodplain soils downward or horizontal excavations to increase floodplain storage and value.

Streams

Stream systems in the Corsica watershed may be degraded for a number of different reasons. Poor water quality can impair habitat for aquatic organisms. Excessive runoff can impair the physical nature of the stream system. Based on information collected by the Maryland Biological Stream Survey (MBSS), the Corsica River watershed has a low overall score for habitat biotic integrity and suggests that this watershed has significant physical habitat concerns. The station for the Rapid Bio-Assessment at Three Bridges Branch has rating of poor to fair where the station at Old Mill Stream has ratings of fair to good. Both areas were singled out as having heavy sediment loads.

Opportunities for stream restoration and enhancement can will likely focus on opportunities which will reconnect, or provide a more frequent connection of the stream to the adjacent floodplain area. This can be accomplished in a number of different ways. Including:

1. **Installation of Grade Control Structures** - Grade control structures can increase the elevation of the stream and reduce overall channel capacity. This can result in a more frequent "out-of-bank" event and increase contact with the floodplain. Provided the floodplain is intact, vegetatively, this can improve water quality.

2. **Installation of weirs, vanes, etc. –** These structures can reduce erosion on streambanks and increase habitat within the stream channel.

3. **Installation and Expansion of Stream Buffers –** According to the 1998 Maryland Clean Water Action Plan, approximately 37% of the streams in the Corsica River are not buffered with woody vegetation. In addition there are many hundreds of acres of stream buffers that could be expanded to provide more protection for water quality.

Submerged Aquatic Vegetation and Oyster restoration opportunities

Restoration: Bottom Mapping

Mapping of bottom characteristics prior to restoration activities is a necessary component of both oyster and SAV restoration. Cooperative bottom mapping activities have been undertaken by the Maryland Geological Survey, the Oyster Recovery Partnership and the NOAA-Chesapeake Bay Office in recent oyster restoration efforts. In that cooperative effort the Maryland Geological Survey has filled the role of data analysis, interpretation and creation of map and GIS products. The mapping effort will utilize acoustic capabilities, including side-scan sonar, sub-bottom profiling and bottom classification. Use of the combined acoustic instrumentation will permit the development and presentation of continuous maps of the Corsica River bottom and near sub-bottom throughout the tidal portions of the river. These acoustic map products can also be used to target areas suitable for both oyster and SAV restoration efforts.

The side-scan sonar system ensonifies the sediment surface as well as a thin near-surface layer and presents results that enable interpretation of the surficial characteristics of the bottom. These characteristics would include presence of seasonal SAV, oysters, small to large scale surface features such as sand waves, topographic breaks and items that stand above the bottom, as well as differentiation of soft muddy bottom sediments from areas composed of sandy sediments. The aerially continuous nature of the resultant data enables maps of the bottom to be readily developed.

The sub-bottom profiling equipment ensonifies the layers of sediments directly below the boat path thus enabling an internal view of the sediment layers that occur below the sediment water interface. These results may be used to determine internal layers of sediments that may have resulted from changes in sedimentation rates, alterations in currents and river flow characteristics, and resulting burial of bottom features including oysters.

The Acoustic Sediment Classification System also ensonifies the bottom directly below the vessel path, and the results can be used to classify the surficial sediments into areas with differing acoustic characteristics. The acoustic differences can be linked to such things as variations in the sediment composition related to grain size, the presence of differing populations of benthic infauna and epifauna, and the presence and density of SAV and macroalgae.

Objectives

- Ground truth, analyze, interpret, and create maps of bottom characteristics within the Corsica River using side-scan sonar, sub-bottom profiling and acoustic sediment classification data supplied by the NOAA-Chesapeake Bay Program.
- Map the surficial sediment using grab samples and analyze them for the physical and chemical properties (e.g. grain size, nutrients, and metals) that directly effect sediment oxygen demand (SOD) and nutrient recycling.

Current Bottom Mapping Status and Activities
At the present time no bottom mapping studies have been conducted in the Corsica River. Portions of the Chester River adjacent to the confluence with the Corsica have been mapped as part of the cooperative program with the Oyster Recovery Partnership (ORP) and the NOAA-Chesapeake Bay Program Office.

Proposed Bottom Mapping Activities
Maryland Geological Survey proposes to analyze, interpret, and create maps of bottom characteristics within the Corsica River using data supplied by the NOAA-Chesapeake Bay Program. The primary data sets will consist of multiple acoustic remote sensing technologies. The acoustic equipment employed will include:

1) Side-Scan sonar,
2) Sub-Bottom Profiling, and
3) Acoustic Sediment Classification using Quester Tangent Impact® system.

Coastal and Estuarine Geology Program (C&EGP) personnel have extensive experience collecting, analyzing, and interpreting these data sets throughout the Bay. NOAA-CBP has the vessel and personnel to collect the data using the same technologies used by C&EGP, and will rely on the State personnel to interpret the data and produce final products.

To provide ground truth for the remotely sensed data C&EGP personnel will collect a approximately 20 bottom samples using a surficial grab sampler, a gravity corer or a piston corer, depending on an initial interpretation of the data. The collected sediments will be described and analyzed in the laboratory of the Maryland Geological Survey for constituent grain size characteristics as well as carbon, nitrogen and sulfur.

Interpretation of the results from the acoustic methodologies can be used in combination to determine sediment movement in the area of study, sedimentation and burial of oyster shells and bars, suitability of bottom type for SAV habitat and the distribution of bottom habitat types.

The various acoustic data sets will be analyzed for bottom habitat types and characteristics that are deemed suitable for development of restored oyster bottom, planting of SAV, and identification of bottom habitats. As part of the products, the side-scan sonar imagery will be mosaiced and georeferenced, providing a complete interpretation of the bottom characteristics across the entire tidal portions of the Corsica River. The differing bottom characteristics and habitat types will be cross referenced with the sub-bottom profiling data, and the acoustic sediment classification data. Results of this interpretation will be assembled in, and provided as, GIS products using ArcGIS software capabilities. These results will be provided as printed map products and on CD/DVD. A summary report outlining the methods and procedures utilized in the collection and analysis of the data will also be provided. The data will also be available in the native collected formats and will be fully documented with associated metadata.

The bottom mapping component of the overall project in the Corsica River needs to be conducted one time at the beginning of the project because the textural characteristics will not change appreciably during the restoration efforts. However, small follow-up surveys can be conducted on an as needed basis in future years at the sites of specific oyster or SAV restoration activities. Because these would cover only a small portion of the entire tidal river system, the budget would be appreciably smaller than the initial survey of the entire system. It is anticipated that interpretation of data in small restoration specific areas would be approximately $5,000.

Budget: Bottom Mapping

Bottom Mapping (First Year Cost)		
Salary and Fringe………………………………………………………………...	$	3,900
2 Weeks FTE – Principal Geologist (Grade 19, Step 15)		
(Salary = $68,322 x 4.17%, Fringe = 37% of Salary)		
Salary and Fringe………………………………………………………………...	$	5,709
1 Month FTE – Water Resource Engineer III (Grade 17, Step 12)		
(Salary = $56,616 x 8.33%, Fringe = 21% of Salary)		
Salary and Fringe………………………………………………………………...	$	4,061
1 Month FTE – Geologist II (Grade 12, Step 2)		
(Salary = $34,315 x 8.33%, Fringe = 42% of Salary)		
Vessel		
1 Cruise @ 8 hours…………………………………………………………	$	1,120
Fuel…………………………………………………………………………	$	250
Supplies………………………………………………………………………….	$	300
Communication………………………………………………………………….	$	55
Travel (mileage @ $0.34)……………………………………………………….	$	80
GIS Lab usage @ $75/day……………………………………………………….	$	300
Reproduction/Printing…………………………………………………………...	$	150
Overhead (35% Salary and Fringe)……………………………………………...	$	4,784

Total Costs: Bottom Mapping

Year	**Cost**
2005 (Year 0)	$0
2006 (Year 1)	$20,709
2007 (Year 2)	$0
2008 (Year 3)	$0
2009 (Year 4)	$0
2010 (Year 5)	$0
TOTAL	**$20,709**

Restoration: Submerged Aquatic Vegetation (SAV)

The criteria for submerged aquatic vegetation (SAV) restoration is to select watersheds with water bodies where SAV beds can be established or expanded. Potential restoration sites are identified by assessment of existing habitat information including but not limited to water quality, substrate, proximity to existing SAV beds and protection from hydraulic clam dredging activities. Potential sites passing initial criteria are then evaluated with two years of spatially intensive habitat surveys and two years of site-specific habitat surveys (test plantings, intensive monitoring, additional assessments) to ensure that the site is suitable for larger scale planting or seeding. The goal of SAV restoration is to jump-start local populations by restoring SAV in suitable areas currently devoid of SAV. In cases where a site is currently vegetated by one species, opportunities may exist to increase species diversity or reintroduce indigenous species. It is important to note that successful bay grass restoration requires suitable water quality conditions for bay grass survival and growth. These conditions must exist if SAV goals for the Corsica River are to be met.

Objectives

- Plant or seed 10 acres of bay grasses in suitable restoration areas.

Current Submerged Aquatic Vegetation Status

As of 2003, the Corsica River had very sparse SAV coverage only visible by ground surveys. While 2004 survey results have not been processed by Virginia Institute of Marine Science **(**VIMS), preliminary estimates approximately 10 acres of SAV present in the Corsica River. Ground truthing in 2004 suggests that this is primarily common waterweed (*Elodea canadensis*). Prior to 2004, the existing SAV beds were primarily composed of widgeon grass grass (*Ruppia maritima*), a species known for great inter-annual variability. If water clarity was improved in the Corsica River as a result of nutrient reduction (WWTP upgrade), a large natural expansion of widgeon is possible without directed SAV restoration activities.

There is no SAV goal specifically for the Corsica River but an SAV goal for the entire meso-haline portion of the Chester River (2724 acres) encompassing the Corsica River. However, an analysis of historical photos identifies 127 acres in Corsica River, which will be used as a target.

Current Submerged Aquatic Vegetation Restoration Activities

The species and restoration techniques chosen will depend largely upon the results of the Anne Arundel Community College (AACC) large-scale propagation study (to be completed in 2005). Specific sites will be selected by two years of rigorous habitat monitoring and test plantings. In 2004, TEA began evaluating SAV restoration potential at several sites in the Corsica River. Small (~$2m^2$) plots of sago pondweed (***Stuckenia** pectinatus*), redhead grass (*Potamogeton perfoliatus*) and wild celery (***Vallisneria*** *americana*) were planted at three sites in the upper reaches of the river in June, 2004. Plants survived at each site through October 2004, with sago pondweed and redhead grass surviving best downriver, and wild celery doing well upriver. If a suitable site is currently vegetated by one species, opportunities may exist to increase species diversity or re-introduce indigenous species.

Total Water Surface Area (acres)	Historical SAV (acres)	Total Area Vegetated (2001-2003) (acres)	Recent SAV Species Present	Possible SAV Restoration Species
1333	127	0	Widgeon Grass, Common waterweed	Redhead Grass, Sago Pondweed, Wild Celery

Proposed Submerged Aquatic Vegetation Restoration Activities

<u>2005 (year 0)</u>

- RAS/TEA will develop techniques for large-scale bay grass restoration, including experimenting with wild celery seeds and sago pondweed and redhead tubers (May 2005)
- RAS/TEA will plant approximately 200 sq meters and monitor growth and survival (monthly, May through October 2005)
- RAS/TEA will produce additional tubers and collect wild celery seeds for 2006 restoration work (Grow plants to produce tubers in June, harvest seeds and tubers in October 2005)
- Disperse seeds in late fall 2005 or early winter 2006

<u>2006 (year 1, dependent on funding and suitable water quality conditions)</u>

- RAS/TEA will plant 1 acre of bay grasses, based on species and techniques evaluated in 2005
- RAS/TEA will monitor growth and survival monthly, May through October 2006
- RAS/TEA will produce additional tubers and collect wild celery seeds for 2007 restoration work (Grow plants to produce tubers in June, harvest seeds and tubers in October 2006)

<u>2007 (year 2, dependent on funding and suitable water quality conditions)</u>

- RAS/TEA will plant 1 acre of bay grasses, based on species and techniques evaluated in 2005 and the results of the 2006 work
- RAS/TEA will monitor growth and survival monthly, May through October 2007
- RAS/TEA will produce tubers and collect wild celery seeds for 2008 restoration work (Grow plants to produce tubers in June, harvest seeds and tubers in October 2007)

2008 (year 3, dependent on funding and suitable water quality conditions)

- RAS/TEA will plant 2 acres of bay grasses, based on species and techniques evaluated in previous years
- RAS/TEA will monitor growth and survival monthly, May through October 2008
- RAS/TEA will produce tubers and collect wild celery seeds for 2009 restoration work (Grow plants to produce tubers in June, harvest seeds and tubers in October 2008)

2009 (year 4, dependent on funding and suitable water quality conditions)

- RAS/TEA will plant 3 acres of bay grasses, based on species and techniques evaluated in previous years
- RAS/TEA will monitor growth and survival monthly, May through October 2009
- RAS/TEA will produce tubers and collect wild celery seeds for 2010 restoration work (Grow plants to produce tubers in June, harvest seeds and tubers in October 2009)

2010 (year 5, dependent on funding and suitable water quality conditions)

- RAS/TEA will plant 3 acres of bay grasses, based on species and techniques evaluated in previous years
- RAS/TEA will monitor growth and survival monthly, May through October 2010

Budget: Submerged Aquatic Vegetation Restoration

SAV Restoration		
Seed/Plant SAV (10 acres @ $16,000/acre)…………………………….........	$	160,000
1 acre to be planted in Years 1 and 2		
2 acres to be planted in Year 3		
3 acres to be planted in Years 4 and 5		
Monitor SAV and Analyze Data		
VIMS Aerial Surveys ($3,000/year x 5 years)………………………………..	$	15,000
Ground Surveys ($1,000/year x 5 years)…………………………………...	$	5,000

Total Costs: SAV Restoration Component

Year	Cost
2005 (Year 0)	$10,000
2006 (Year 1)	$20,000
2007 (Year 2)	$20,000
2008 (Year 3)	$36,000
2009 (Year 4)	$52,000
2010 (Year 5)	$52,000
TOTAL	**$190,000**

Restoration: Oysters

Goal
To implement an oyster project of up to 20 acres in the Corsica River in summer/fall 2005.

Method
A field survey will locate suitable bottom for the oyster project. A meeting will be held with clammers and other parties to confirm/approve the site (the river bottom is clam bottom). Then shells will be planted on the site to build the oyster bar. Next, seed oysters from the Horn Point hatchery (UMD) will be planted on the shelled site to create the oyster population. Also in this timeframe of shell and seed planting, a public notice process will reclass the site as oyster bottom and will close the area as an oyster sanctuary.

Projected Timeline

Mid-June	River bottom survey by ORP/NOAA Data analysis begins by MGS using the NOAA field data
July	Field data analysis to be available from MGS Suitable sites will be mapped DNR Shellfish to select priority location(s) from the list of suitable sites DNR Shellfish meets with clammers to confirm/approve the site(s)
August	Shells planted on the suitable site(s) 20 acres is the goal. A single 20 acre site may not be available in the river A set of smaller sites may be needed to acquire 20 acres Seed planted on the shelled site(s) Public notice process begins to close the site(s) to harvest
Sept or Summer 2006	Fallback timeframe for seeding – depending on availability of seed

Issues
The main issue is seed. The hatchery is having difficulty this summer and seed oysters are in very short supply. Many projects are ahead of the Corsica Project. It may be next year that the seed are planted.

Clam bottom. The river bottom is legally clam bottom. A public process is needed to acquire a site for the oyster project. The survey needs to be conducted asap in order to stat the discussions with the clammers.

Contact: Chris Judy, DNR Shellfish Program Director